

Six new infraspecific taxa in *Eucalyptus* (*Myrtaceae*) for Victoria

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Introduction

The six new taxa described here are some of several recently discovered, unnamed eucalypts occurring in Victoria. Others will be treated in future papers. All six are markedly restricted and are described as subspecies within three existing species. Two subspecies occur in the Wimmera region; *Eucalyptus viminalis* Labill. subsp. *siliceana* Rule is from the Wail State Forest, and *E. goniocalyx* F. Muell. ex Miq. subsp. *viridissima* Rule is from Mt. Arapiles and in parts of the northern Grampians. Three subspecies occur near Bacchus Marsh; *E. goniocalyx* F. Muell. ex Miq. subsp. *laxa* Rule, is from the Brisbane Ranges to the south-west of Bacchus Marsh, *E. goniocalyx* F. Muell. ex Miq. subsp. *fallax* Rule in the Blackwood Range to the north-west of Bacchus Marsh, and *E. baueriana* Schauer subsp. *thalassina* Rule is from the Werribee River catchment area. *Eucalyptus baueriana* Schauer subsp. *deddickeensis* Rule is from the Deddicke River in East Gippsland. The affinities, ecology, distribution and conservation status of each taxon are discussed.

Materials and Methods

Seedlings of all taxa described below were raised both in the nursery of the Melbourne Botanic Gardens and in private nursery facilities using standard native plant potting mixes. As well as for comparing these seedlings with those representing provenances of the typical forms of each species, another important purpose of these progeny trials has been to determine whether any of these very restricted taxa have been derived from hybrid stock. Leaf thicknesses of fresh adult leaves collected in the field were measured using a dial calliper.

Taxonomy

Series Viminales Blakely MANNA GUM COMPLEX

Eucalyptus viminalis was described in 1806. *Eucalyptus pryoriana* L.A.S.Johnson was described in 1962 on the basis of its persistent rough bark extending to the upper branches, but was changed to a subspecies of *E. viminalis* by Brooker and Slee (1996). Its distribution

Abstract

Six new subspecies of *Eucalyptus* are described from Victoria, a rough-barked manna gum, *E. viminalis* subsp. *siliceana*, three long leaf boxs; *E. goniocalyx* subsp. *viridissima*, *E. goniocalyx* subsp. *laxa*, and *E. goniocalyx* subsp. *fallax*, and two blue boxs' *E. baueriana* subsp. *thalassina*, and *E. baueriana* subsp. *deddickeensis*.

Keywords: manna gum, long-leaf box, blue-box, geographically restricted

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was given as sandy coastal areas of the Port Phillip region and South Gippsland. *Eucalyptus viminalis* subsp. *cynetensis* Boomsma was erected in 1980 to cater for South Australian and western Victorian populations of manna gum with persistent box-like bark and 7-flowered inflorescences. The distribution given for South Australia was the southern extremity of the Eyre Peninsula, Kangaroo Island, the Lofty Ranges and the Lower South-east and the Lower Murray Mallee regions and, for Victoria, the South-west and Wimmera regions. However, both Brooker and Slee (1997) and Nicolle (2006) noted that, although the subspecies is predominantly 7-flowered, populations with trees with mixed 3 and 7-flowered inflorescences have been recorded. *Eucalyptus nobilis* L.A.S.Johnson & K.D.Hill was described in 1990 as a tall forest tree of northern New South Wales and south-east Queensland with smooth bark, broadly lanceolate juvenile leaves and 7-flowered inflorescences. *Eucalyptus viminalis* subsp. *hentyensis* Brooker & Slee was described in 2002 to accommodate small trees of the west coast of Tasmania with smooth bark, ovate-lanceolate juvenile leaves

and 3 and 7-flowered inflorescences. The taxonomic standing of this taxon has been questioned by some observers, for example, Nicolle (2006).

Although the number of buds per inflorescence of *E. viminalis* subsp. *hentyensis* is mixed, this feature is given as being consistent within all its populations. However, variable inflorescence numbers do occur in low frequencies within *E. viminalis*, mostly in coastal areas of southern Victoria. In my view some of these forms should be regarded as variants within existing subspecies as they are otherwise indistinguishable from normal trees of those subspecies. Brooker and Slee (1996) speculated that mixed 3 and 7-flowered inflorescences occur in populations of *E. viminalis* subsp. *cynetensis*, to the west of Melbourne and along the south-west coast near Anglesea. Nicolle (2006) also noted the presence of forms, presumably with some aberrant inflorescence numbers, occurring between Port Phillip Bay and Port Campbell and alluded to them being intergrades between subsp. *cynetensis* and subsp. *pryoriana*. However, trees with 7-flowered inflorescences or a mixture of inflorescences that

Key to the manna gum complex

1 Inflorescences only 3-flowered	2
1: Inflorescences 7-flowered or mixed 3 and 7-flowered	3
2 Rough bark persistent to the secondary branches	<i>E. viminalis</i> subsp. <i>pryoriana</i>
2: Rough bark, if present, absent from the upper trunk	<i>E. viminalis</i> subsp. <i>viminalis</i>
3 Inflorescences 7-flowered	4
3: Inflorescences mixed 3 and 7-flowered	5
4 Bark smooth throughout	<i>E. nobilis</i>
4: Rough bark extending to the major branches	<i>E. viminalis</i> subsp. <i>cynetensis</i>
5 Bark smooth throughout	<i>E. viminalis</i> subsp. <i>hentyensis</i>
5: Rough bark present at least to the mid-trunk	6
6 Seedling growth tips glaucous; fruits 4-6 mm diam	<i>E. viminalis</i> subsp. <i>siliceana</i>
6: Seedling growth tips green; fruits 5-9 mm diam.	7
7 Rough bark confined to the lower trunk	<i>E. viminalis</i> subsp. <i>viminalis</i>
7: Rough bark extending to at least the major branches	8
8 Rough bark extending to the secondary branches; bark on lower trunk blackish-brown; broadest adult leaves 2.5 cm wide	<i>E. viminalis</i> subsp. <i>pryoriana</i>
8: Rough bark extending to upper trunk or major branches; bark on lower trunk light grey; broadest adult leaves 3.5 cm wide	<i>E. viminalis</i> subsp. <i>cynetensis</i>

are 3 and 7 flowered also occur on the Mornington Peninsula and in South Gippsland to the east of Wonthaggi and, in my view, are difficult to separate from subsp. *pryoriana* on other characters. There are also small occurrences of trees with mixed 3 and 7-flowered inflorescences occurring in the Brisbane Ranges, to the south of Ballarat and in the Grampians which otherwise are inseparable from trees of the typical subspecies. Further, scrubby trees with mostly 3-flowered inflorescences, relatively broad adult leaves and relatively large fruits occur along the coast near Portland. In my view these trees cannot be readily assigned to any existing subspecies and, therefore, are worthy of more study.

Recent surveys of eucalypts in the Wimmera region of western Victoria by the author have led to the discovery of a distinct, markedly restricted manna gum occurring in the Wail State Forest near Dimboola. It is treated here as a new subspecies within *E. viminalis*.

Eucalyptus viminalis Labill. subsp. *siliceana* Rule sp. nov.

Eucalyptus viminalis subsp. *siliceana*: A subspeciebus aliis foliis juvenilibus angustoribus pruinosis, inflorescentiae 3 et 7 floribus et fructibus minoribus differt.

Type: Victoria: Wail State Forest, 0.7 km W along Wimmera Track from North Track, 36° 29' 00" S. 142° 03' 01" E, K. Rule 2108 and J. Jeanes, 13 viii 2008, (holotype: MEL 2324025; isotypes: AD, CANB. NSW).

Umbrageous trees to 15 m tall. Bark grey-brown, rough, sub-fibrous, thick, deeply furrowed, crusty, persistent to the upper trunk; branches clean, whitish or pale brown, decortication in short strips or ribbons. Seedling leaves elliptical, decussate, sessile, discolorous, pale green. Juvenile leaves narrowly lanceolate, opposite, sessile, basally obtuse and sometimes amplexicaul, persisting for numerous pairs, apiculate or acuminate, slightly discolorous, dull, blue-green to sub-glaucous with glaucous growth tips, 4–8 cm long, 0.6–1.2 cm wide. Intermediate leaves lanceolate, broader than juvenile leaves, becoming shortly petiolate, disjunct, light green; growth tips lightly glaucous in the growing season. Adult leaves lanceolate, petiolate, disjunct, acuminate, thin-textured (0.15–0.24 mm thick), moderately reticulate, dull, blue-green in winter, sub-lustrous, light-green in summer, 8–15 cm long,

1.2–2.3 cm wide; petioles 0.8–1.8 cm long; lateral veins moderately visible, moderately acute (25–35° from mid-vein); intramarginal vein 1–2 mm from margin; oil glands small, irregular, numerous, mostly island. Branchlets sometimes faintly pruinose during the growing season. Inflorescences simple, axillary, mixed 3 and 7-flowered on individual trees; peduncles, slender, slightly angular, terete, 7–11 mm long. Floral buds ovoid, shortly pedicellate, scarred (outer operculum shed in early bud development), sometimes faintly pruinose at anthesis, 3 or 4-loculed, 6–9 mm long, 3–4 mm wide; pedicels 2–4 mm long; operculum conical, often slightly beaked, flush with the hypanthium at the abscission zone, 3–4 mm long; stamens irregularly flexed, all fertile; filaments white; anthers dorsifixed, versatile, oblong-cuneate, dehiscing through longitudinal slits; ovules in 4 vertical rows. Fruits ovoid or sub-globoid, sub-sessile or shortly pedicellate, 4–6 mm long (including valves), 4–6 mm wide; rim slightly above the mid-point of the fruit; disc steeply ascending; valves 3 or 4, slightly exserted. Fertile seeds black, irregularly ovoid, pointed at one end, tooth-edged, shallowly pitted; hilum ventral.

Flowering period: Autumn.

Additional specimens examined: VICTORIA: Wail State Forest, 36° 29' 22" S. 142° 02' 41" E., K. Rule 0056, 27.vi 2000, MEL 2324027; Wail S. F., 36° 29' 44" S. 142° 02' 54" E., K. Rule 0211, 14 iii 2002, MEL 2324026: Wail State Forest, 200 m N of Ironbark Track, 1.5 km SW of Break Track, 36 30 01 S. 142 02 42 E., D. Cameron sn 30 ix 2009 (MEL).

Distribution and habitat: *Eucalyptus viminalis* subsp. *siliceana* is known only from the Wail State Forest in the Victorian Wimmera region where it grows in impoverished, deep, white, siliceous sands (Fig.1).

Associated species: *Eucalyptus camaldulensis* Dehnh. subsp. *camaldulensis*, *E. arenacea* Marinson & Ladiges, *E. leucoxylon* F.Muell subsp. *stephaniae* Rule and *E. leucoxylon* subsp. *pruinosa* Boland occur in the Wail State Forest but not with the new taxon which, as far as is known, occurs in pure stands.

Etymology: The epithet is based on the Latin *siliceus* which is an adjectival form of *silex* 'flint' or 'silica'. The suffix *ana* denotes a link between the new taxon and its habitat.

Conservation status: The single population of the new taxon is scattered sparsely through the northern part of the Wail State Forest which is located on the

eastern side of the Wimmera River. Although the exact numbers of the new taxon are not known, it is estimated that between 300 and 400 mature trees exist. Given its small numbers and its location within a state forest where there is no guarantee of long-term protection, in accordance with IUCN (2001) criteria, a conservation status for the new taxon of endangered is recommended.

Discussion: Some features of *E. viminalis* subsp. *siliceana* have raised the question of whether it is a part of the hybrid entity, *E. huberiana* Naudin. Blakely (1934) described *E. huberiana* to accommodate 7-flowered populations of manna gum occurring in Queensland, New South Wales, Victoria and Tasmania. Other features used by Blakely to distinguish the taxon from 3-flowered manna gums were its basal box-like bark, its sometimes sub-glaucous young twigs and buds and its relatively small fruits (6-8 mm long, 5-6 mm diam). Such authors as Pryor and Willis (1954), Pryor (1955) and Boomsma (1972) applied the name to variable populations occurring in western Victoria and south-east South Australia, which were presumed to be

natural hybrids between *E. viminalis* and *E. aromaphloia* Pryor & Willis, but are now recognised as *E. sabulosa* Rule and *E. viminalis* subsp. *cynetensis*. Johnson and Hill (1990) noted that the concept of *E. huberiana* was an aggregate of at least two now recognised taxa (*E. nobilis* and *E. viminalis* subsp. *cynetensis*), as well as hybrids in the New England region of New South Wales between *E. viminalis* and *E. nova-anglica* Dean & Maiden. They also noted that no type specimen had been designated for *E. huberiana*. In my view, the form of manna gum described here as *E. viminalis* subsp. *siliceana*, is not consistent with the concept of *E. huberiana*, despite the two sharing particular features (box-like bark, glaucousness and small fruits). Progeny trials have indicated that this entity is true-breeding and field studies have revealed uniformity in adult morphology (except for bud number). These, together with its location being in a habitat not consistent with Blakely's description, not only eliminate the possibility that it is a part of *E. huberiana* but reinforce the case for its acceptance as a new taxon.

E. viminalis subsp. *siliceana* is distinguished within

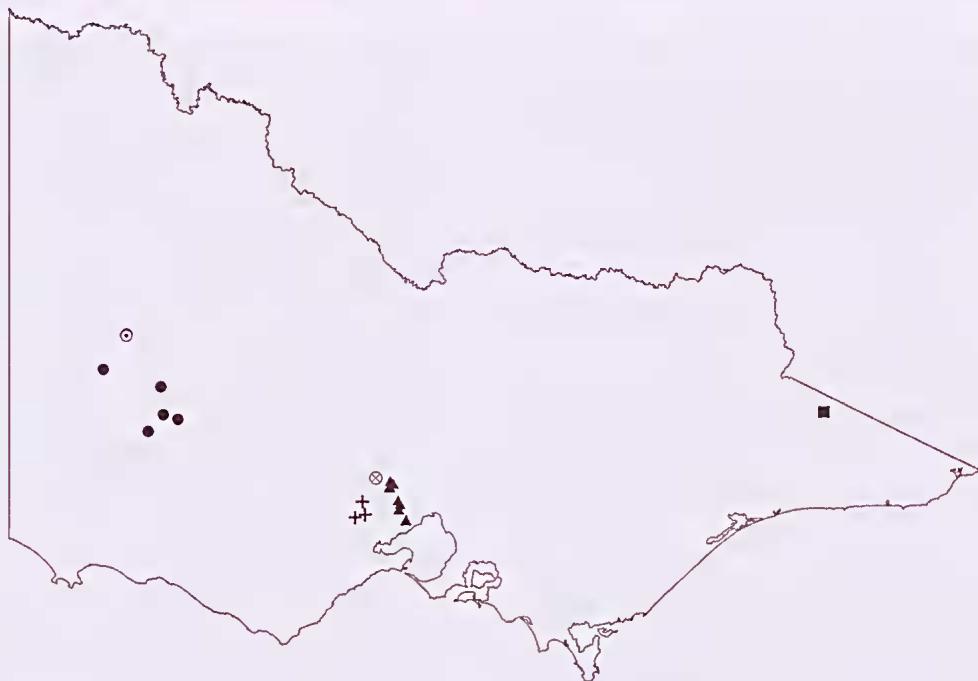


Figure 1. Distribution Map: *E. viminalis* subsp. *siliceana* (open circle with dot); *E. ganiacalyx* subsp. *viridissima* (closed circle); *E. ganiacalyx* subsp. *laxa* (cross); *E. ganiacalyx* subsp. *fallax* (open circle with cross); *E. baueriana* subsp. *thalassina* (closed triangle); *E. baueriana* subsp. *deddicensis* (closed square).

the manna gums by the combination of features which include its umbrageous habit, its thick, crusty, deeply fractured, sub-fibrous, box-like bark, which extends to the major branches, its narrowly lanceolate, dull, blue-green to sub-glaucous juvenile leaves with glaucous growth tips, its sometimes lightly pruinose buds and branchlets, its dull or sub-lustrous, bluish to light green, generally small adult leaves, its mixed 3 and 7-flowered inflorescences and its relatively small, ovoid or globoid fruits with a steeply ascending disc.

Forms of both *E. viminalis* subsp. *viminalis* and *E. viminalis* subsp. *cynetensis* occur in the Wimmera region but to the south of the new subspecies in habitats of higher rainfall. *Eucalyptus viminalis* subsp. *viminalis* occurs in the Grampians and adjacent areas and differs by its more erect, taller habit, mostly smooth bark, lustrous, green juvenile leaves, greener adult leaves, mostly 3-flowered inflorescences and generally larger fruits with a slightly ascending disc (fruits 6-8 mm long, 5-8 mm diam). *Eucalyptus viminalis* subsp. *cynetensis*, which occurs on the southern side of the Little Desert, resembles the new subspecies in both habit and bark, but differs by its lustrous and green juvenile leaves, generally larger adult leaves (to 30 cm long, 3.5 cm wide), mostly 7-flowered inflorescences and larger fruits (6-9 mm long, 6-9 mm diam).

Series *Globulares* Blakely LONG LEAF BOX COMPLEX

The long leaf box complex or the informal Superspecies *Goniocalyx* (Pryor and Johnson 1971) forms a part of the Series *Globulares* as applied by Brooker (1997, 2000) and is used in this context to facilitate some comparisons between closely related taxa. *Eucalyptus goniocalyx* F.Muell. ex Miq., described in 1856, occurs widely throughout New South Wales, Victoria and South Australia and is characterised by its smallish, usually spreading habit (up to 15 m tall), rough, box-like bark, which extends to the upper branches, sessile, orbicular, glaucous juvenile leaves, relatively long, green adult leaves, cylindrical, waisted, sessile buds with opercula variable in shape, size and width in relation to the hypanthium and tightly-packed, sessile, fruits, which are highly variable in both shape and size (cupular, sub-cylindrical, barrel-shaped or obconical and 6-10 mm long, 5-10 mm diam).

E. banksii Maiden, which occurs in northern New South Wales and south-east Queensland, was described in 1905 and differs from *E. goniocalyx* by its broadly ovate or cordate juvenile leaves, its grey-green adult leaves, its shorter peduncle, its squat, ovoid buds with a hemispherical operculum and its smaller, hemispherical fruits (4-5 mm long, 4-5 mm diam.).

Whilst *E. banksii* is morphologically discrete within the group, *E. nortonii* L.A.S.Johnson, described in 1962, is widely scattered throughout inland areas along the Great Dividing Range in both New south Wales and Victoria and is similar to *E. goniocalyx* in most features (habit, bark, seedlings, adult leaf sizes and bud and fruit shapes and sizes) but differs primarily by its pruinose branchlets, buds and immature fruits and greyish or glaucous adult leaves. Johnson noted that, at its type locality, *E. nortonii* is separable from *E. goniocalyx* by its larger flowers and coarser fruits, but in southern populations in Victoria, the boundaries between the two in these characters are somewhat blurred.

E. volcanica L.A.S.Johnson & K.D.Hill was described in 1990 to accommodate populations occurring in the Nandewar and Warrumbungle Ranges. Its distinguishing features given are its persistent rough bark on the trunk, glaucous, orbicular juvenile leaves, acute conical operculum with a basal constriction and pedicellate, basally-tapered fruits. Although it has similar bark and juvenile leaves to *E. goniocalyx*, the authors regarded it as more closely related to *E. cypellocarpa* L.A.S.Johnson. In this paper, in accordance with Johnson and Hill's assessment, it is not regarded as a member of the *E. goniocalyx* complex and does not figure in the key provided below.

Eucalyptus goniocalyx subsp. *exosa* Nicolle was described in 2000 to accommodate a mallee form of long leafbox occurring in the Northern Flinders Ranges. However, Brooker and Kleinig (1990) had suggested that this taxon might be regarded as a separate species because it differs from the typical eastern Australian form of the species by its unique habitat, stature, habit and juvenile leaves.

Recent studies by this author have shown that three additional taxa within the long leaf box complex are worthy of taxonomic recognition, each of which is recognised here as subspecies within *E. goniocalyx*. The first occurs at Mt. Arapiles and at several sites in the northern Grampians and is distinguished primarily by

its juvenile leaves. Both the second and third subspecies occur in the Bacchus Marsh area, one restricted to the Brisbane Ranges and the other to the Blackwood Range, each of which is distinguished primarily from the typical subspecies by its unusual bark.

***Eucalyptus goniocalyx* F.Muell. ex Miq.
subsp. *viridissima* Rule subsp. nov.**

Eucalyptus goniocalyx subsp. viridissima: A subspeciesbus aliis foliis juvenilibus viridioribus nitentoribus et operculo hypanthio latiore differt.

Type: Victoria: Summit of Mt. Arapiles, 36° 45' 03"S., 142° 50' 02"E., 13 v 2010 K. Rule 3610, MEL (isotypes AD, CANB, NSW).

Spreading, often multi-trunked trees to 10 m tall. Bark light grey, scaly, box-type, persistent on upper trunk and sometimes major branches; branches usually smooth, white or light brown; old bark decorticate in short ribbons. Seedling leaves ovate, sessile, decussate, discolorous, blue-green above, whitish below. Juvenile leaves orbicular, often emarginate, opposite, sessile, amplexicaul, coarse-textured, discolorous, lustrous, dark green above, pale green below, 3–8 cm long, 3–8 cm wide; growth tips lustrous; seedling stems initially

square in cross section but round after about 5 nodes. Intermediate leaves ovate, becoming petiolate, disjunct and concolorous. Adult leaves lanceolate, falcate, acuminate, moderately reticulate, coriaceous (0.38–0.52 mm thick), lustrous, green, 10–24 cm long, 2–3.2 cm wide; petioles 1.8–3.1 cm long; intramarginal vein 2–3 mm from margin; oil glands regular, numerous, mostly island. Inflorescences simple axillary, 7-flowered; peduncles initially broadly flattened, 10–16 mm long, to 3–4 mm wide, becoming angular and thicker with age. Floral buds cylindrical, tightly sessile, often slightly waisted at the mid-point, scarred (outer operculum shed in early development), faintly to prominently bicostate, 3 or 4-loculed, 8–13 mm long, 4–6 mm wide; operculum conical, sometimes shortly beaked, wider than the hypanthium, 4–7 mm long; stamens irregularly flexed, all fertile, filaments white; anthers dorsifixed, oblong-cuneate, versatile, dehiscing through longitudinal slits; ovules in 4 vertical rows. Fruits obconical, cupular or sub-cylindrical, sessile, faintly to prominently ribbed, 8–12 mm long, 7–10 mm wide, disc more or less level with the rim; valves 3 or 4 slightly exserted. Fertile seeds black, irregularly elongated, lacunose; hilum ventral.

Flowering period Autumn.

Key to members of the long leaf box complex

1 Peduncles 2–6 mm long; fruits to 3–6 mm long	<i>E. banksii</i>
1: Peduncles 5–18 mm long; fruits 6–12 mm long	2
2 Branchlets, buds and immature fruits pruinose	3
2: Adult structures non-pruinose	4
3 Smooth-barked mallees	<i>E. goniocalyx</i> subsp. <i>exposta</i>
3: Box-barked trees	<i>E. nortonii</i>
4 Juvenile leaves lustrous and green	<i>E. goniocalyx</i> subsp. <i>viridissima</i>
4: Juvenile leaves glaucous or blue-green	5
5 Bark light brown, thin, finely fibrous, peppermint-like, sparsely-fractured (smooth in appearance), extending to the upper trunk	<i>E. goniocalyx</i> subsp. <i>fallax</i>
5: Bark grey to brown, thick, often crusty, tessellated and scaly, box-like, either persisting to the secondary branches or forming a stocking on the lower trunk	6
6 Rough bark only as a stocking on lower trunk; bark above loosely-attached, non-fibrous; bark on branches smooth	<i>E. goniocalyx</i> subsp. <i>laxa</i>
6: Box-like bark extending to the minor branches; bark on lower trunk thick, crusty and deeply fractured, scaly or tessellated above	<i>E. goniocalyx</i> subsp. <i>goniocalyx</i>

Additional specimens examined: VICTORIA: Mt. Victory Road, c. 1 km S of Zumpstein's Res. 37° 05'57"S, 142° 23'40"E, K. Rule 11903, 30 ix 2003, MEL 2324029; Mt. Zero car park, 36° 53'25"S, 142° 22'27"E, K. Rule 93108, 21 xi 1993 MEL 2324031; Stawell-Halls Gap Road, c 0.4 km NE of Delley's Bridge, 37° 07'53"S, 142° 31'37"E, K. Rule 0102, 19 iv 2001, MEL 2324030; Red Rocks, Victoria Range, 37° 13' 30"S, 142° 15' 20"E, K. Rule 5406, 12 iii 2006, MEL 2324032.

Distribution and habitat: The taxon is known from Mt Arapiles and from sites in the northern extremities of the Grampian Ranges, for example, Mt Zero, the Halls Gap area, above Zumpsteins Reserve on the northern slope of the Serra Range and the Red Rocks area in the Victoria Range. At all sites the taxon occurs on impoverished sandstone derivatives (Fig. 1).

Associated species: On the plateau of Mt. Arapiles the new taxon is the dominant eucalypt where it mixes with *E. leucoxylon* subsp. *stephaniae* but spills down through the gullies into mallee communities containing forms of *E. wimmerensis* Rule, *E. costata* F.Muell., *E. leptophylla* F.Muell., *E. calycogona* Turcz. subsp. *trachybasis* Nicolle and *E. phenax* Brooker & Slee subsp. *phenax*. At Mt. Zero *E. obliqua* L'Her., *E. baxteri* (Benth.) Maiden & Blakely, *E. melliodora* A.Cunn. ex Schauer and *E. sabulosa* occur close to or in association with the new taxon. The population to the south of Zumpsteins Reserve occurs with *E. obliqua* and abuts *E. alaticaulis* Watson & Ladiges at higher altitudes and *E. melliodora* close to Zumpsteins Reserve. The typical form of *E. goniocalyx*, which is the more common long leaf box in the Wimmera and which always occurs on heavier soils, occurs to the north of Zumpsteins Reserve. At Halls Gap *E. baxteri*, *E. obliqua*, *E. viminalis* subsp. *viminalis* and *E. ovata* Labill. var *ovata* occur adjacent to the new taxon, whilst at Red Rocks *E. baxteri* is a common associate.

Etymology: The epithet is based on the combination of the Latin *viridis* "green" plus the suffix *issimus* 'very' which alludes to the brilliantly green-coloured juvenile leaves of the subspecies.

Conservation status: Where it occurs, the new subspecies is locally abundant. Further searches of the northern Grampians may reveal additional populations. Although all known populations occur within protected reserves (the Grampians National Park and Mt. Arapiles – Tooan State Park), in accordance with IUCN (2001) criteria a conservation status of vulnerable is recommended.

Discussion: *E. goniocalyx* subsp. *viridiissima* was regarded by Nicolle (2006) as an unnamed species (*Eucalyptus* sp. 'Mt. Arapiles') but he gave its only distinguishing feature as its lustrous and green juvenile leaves. Whilst its juvenile leaves are strikingly different to those of typical *E. goniocalyx*, it is my opinion that this feature and a few other subtly distinguishing features are insufficient to support a status of species. Hence, this taxon is here treated as a subspecies within *E. goniocalyx*.

The new subspecies is distinguished from the typical subspecies by features which include its lustrous, green, coarse-textured juvenile leaves, reduced amount of box bark, with the old bark shedding in ribbons from the major branches, generally longer peduncles (5-10 (-15) mm long in the typical subspecies), buds with the operculum consistently wider than the hypanthium at the join and generally larger fruits (6-10 mm long, 5-10 mm wide in the typical subspecies). It is also ecologically different as it occurs on well-drained sandy soils usually associated with rocky outcrops rather than the heavy clays that are preferred by the other Victorian subspecies.

In the northern extremities of the Grampian Ranges *E. alaticaulis* often occurs adjacent to the new subspecies, but at higher altitudes. Without an intimate knowledge of the two taxa they can be difficult to separate in the field as both have similar juvenile leaves in colour and lustre, as well as similar adult leaves, buds and fruits. However, in the field *E. alaticaulis* is separable by its mostly smooth-barked trunks. In seedling trials, too, it differs by its broadly ovate juvenile leaves and seedling stems that are square in cross-section and winged.

Eucalyptus goniocalyx F.Muell. ex Miq. subsp. *laxa* Rule subsp. nov.

Eucalyptus goniocalyx subsp. *laxa*: A subspeciebus aliis cortice laxo et foliis juvenilibus ovatis glaucescentibus differt.

Type: Victoria: Intersection of Mt. Wallace Road and Old Thompson Road, Brisbane Ranges N. P., 37° 45' 43"S, 144° 14' 51"E, K. Rule 2209, 31vii 09, MEL 2324039 (isotypes: AD, CANB, NSW)

Small, often leaning trees 5-12 m tall. Bark of mature trees grey, box-type, forming a stocking on the lower

trunk to various heights; bark on upper trunk smooth, white or light grey, covered by loosely attached, light grey strips and plates or less often completely smooth; bark of saplings thin, box-like, light grey, irregularly fractured, loosely attached, extending to upper trunk. *Seedling leaves* ovate, sessile, decussate, slightly discolorous, blue-green to sub-glaucous. *Juvenile leaves* sessile, opposite and amplexicaul for numerous pairs, orbicular, discolorous, sub-glaucous for 4-6 pairs, becoming broadly ovate and blue-green and slightly lustrous on the upper surface, apiculate, soft-textured for numerous pairs, but retaining sub-glaucous growth tips, 4-8 cm long, 4-6 cm wide; seedling stems initially square in cross-section, becoming round after about 5 nodes. *Intermediate leaves* longer and greener than juvenile leaves, becoming concolorous, petiolate and disjunct. *Coppice leaves* green. *Adult leaves* lanceolate, falcate, acuminate, moderately reticulate, coriaceous (0.35-0.47 mm thick) lustrous, green, 12-25 cm long, 1.8-3.2 cm wide; petioles 1.8-3.3 cm long; intramarginal vein 2-3 mm from margin, oil glands regular, numerous, mostly island. *Inflorescences* simple, axillary, 7-flowered; peduncles broadly flattened, becoming angular and thicker with age, 10-16 mm long, 2-3 mm wide. *Floral buds* cylindrical, sessile or sometimes shortly pedicellate, faintly ribbed, slightly waisted at mid-point, scarred (outer operculum shed in early bud development, 3 or 4-loculed, 10-14 mm long, 3-5 mm wide; pedicels 0-2 mm long; operculum conical, wider than or as wide as the hypanthium at the join, 3-5 mm long; stamens irregularly flexed, all fertile; filaments white; anthers dorsifixed, versatile oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* barrel-shaped to cupular, basally-tapered, thick-walled, sessile or sometimes shortly pedicellate, often faintly ribbed, 8-10 mm long, 6-8 mm wide; disc descending; valves 3 or 4, enclosed; orifice often narrow. *Fertile seeds* black, irregularly elongated, flattened, lacunose; hilum ventral.

Flowering period Late winter or spring.

Additional specimens examined: VICTORIA: Switch Road, Brisbane Ranges N.P., c. 600 m from Ballan-Geelong Road, 37° 51' 50" S., 144° 14' 51" E., 28 viii 2004, K. Rule 04109, MEL 2324037; Clarkes Road, c. 400 m SW of De Motts Road, 37° 53' 57" S., 144° 13' 20" E., 2 xii 2009, K. Rule 11809, MEL 2324035; Steiglitz Road, c. 700 m E of Sutherland Creek, 37° 52' 56" S.,

144° 10' 48" E, 4 ix 2009, K. Rule 7109, MEL 2324034; Brisbane Ranges N.P., Mt. Wallace Road, 1.3 km NE of intersection with Thompson Road, 37° 45' 27" S., 144° 16' 40" E., 4 ix 2009, K. Rule 6909, MEL 2324038.

Distribution and habitat: *E. goniocalyx* subsp. *laxa* occurs in the Brisbane Ranges to the south-west of Bacchus Marsh in well-watered, heavy soils. (Fig 1).

Associated species: *E. aromaphloia* L.D.Pryor & Willis, *E. tricarpa* subsp. *tricarpa* L.A.S.Johnson & Hill, *E. radiata* subsp. *radiata* Sieber ex DC, *E. macrorhyncha* F.Muell. ex Benth., *E. dives* Schauer, *E. viminalis* subsp. *viminalis*, *E. obliqua*, *E. baxteri* and *E. ovata* var. *ovata* either occur with or adjacent to *E. goniocalyx* subsp. *laxa*. Populations of typical *E. goniocalyx* also occur in the Brisbane Ranges on drier, more exposed sites but contact with the new subspecies has not been observed.

Etymology: The subspecific epithet is derived from the Latin *laxus* "loose" in reference to the loosely attached bark on the trunk of the new taxon.

Conservation status: The bulk of the numbers of *E. goniocalyx* subsp. *laxa* are protected within the Brisbane Ranges National Park. Only a small number of individuals are known to occur along roadsides and on private property at the southern extremity of the distribution. Initially the taxon was thought to consist of only a few hundred trees but recent surveys by this author, particularly in the southern part of the distribution, the numbers are now thought to exceed 2000 trees. In accordance with IUCN (2001) criteria a conservation status of vulnerable is recommended.

Discussion: Parsons and Kirkpatrick (1972) observed that the morphology of this form of long leaf box is intermediate between *E. goniocalyx* and *E. cypellocarpa* in a wide range of juvenile and adult features. They also found from their seedling trials no evidence that would indicate that it was derived from hybrid stock and further concluded that the form has an affinity with *E. goniocalyx*. From my investigations, through seedling trials and field studies, I concur with Parsons and Kirkpatrick's findings entirely. Its lack of persistent box bark throughout its early development of blue-green juvenile leaves and its green coppice leaves are features which might allude to an affinity with *E. cypellocarpa*. However, in my opinion, its buds and fruits, which are mostly sessile, are within the parameters of

E. goniocalyx. For this reason a subspecific position within that species is considered appropriate.

E. goniocalyx subsp. *goniocalyx* differs from the new taxon by its persistent box bark, which extends to the secondary branches, its orbicular, glaucous juvenile leaves and its shorter peduncles (5-10 (-15) mm long).

E. goniocalyx subsp. *viridissima* differs from subsp. *laxa* by its persistent box bark to at least the upper trunk, its lustrous and green, orbicular juvenile leaves, its operculum that is consistently wider than the hypanthium and its generally longer fruits (to 12 mm long in subsp. *viridissima*).

E. goniocalyx subsp. *fallax*, the third new subspecies treated here, differs from subsp. *laxa* by its taller, more erect habit, its persistent, thin, light-brown, sparsely-fractured (smooth in appearance) bark and its orbicular juvenile leaves.

Eucalyptus goniocalyx F.Muell. ex Miq. subsp. *fallax* Rule subsp. nov.

E. goniocalyx subsp. *fallax*: A subspeciebus aliis habitu majoribus, cortice laeve plus minuve et pedunculis longioribus differt.

Type: Victoria: Grassy Gully Track, Lerderderg State Park, 37° 34' 43"S, 144° 22' 01"E. 30 v 2009, K. Rule 2109, (holotype: MEL 2324033; isotypes: AD, CANB, NSW)

Erect trees to 25 m tall. Bark of mature trees dull, light brown, thin, finely fibrous, peppermint-like, sparsely-fractured (smooth in appearance), extending to the upper trunk; bark on branches grey; old bark decorticating in long strips and ribbons; bark of tallish saplings and immature trees light grey, thin and scaly, extending over most of the trunk. Seedling leaves ovate, decussate, discolorous, blue-green to slightly glaucous. Juvenile leaves broadly ovate to orbicular, emarginate, sessile, amplexicaul, discolorous, blue-green for numerous pairs, 4-8 cm long, 4-8 cm wide. Intermediate leaves broadly ovate, petiolate, becoming disjunct, blue-green to green. Adult leaves lanceolate, falcate, acuminate, moderately reticulate, coriaceous (0.33 – 0.47 mm thick) lustrous, dark green, 10 – 18 cm long, 1.5 – 3.2 cm wide; petioles 1.8 – 2.8 cm long; intramarginal vein 2 – 3 mm from margin, oil glands regular, numerous, mostly island. Inflorescences simple, axillary, 7-flowered; peduncles broadly flattened,

11–18 mm long, c. 3 mm wide, becoming angular and thicker with age. *Floral buds* ovoid-cylindrical, sub-sessile or shortly petiolate, faintly ribbed, slightly waisted at mid-point, scarred (outer operculum shed in early bud development, 3 or 4-loculed, 7-10 mm long, 3–4 mm wide; operculum conical, slightly contracted at the join, 3-4 mm long; stamens irregularly flexed, all fertile; filaments white; anthers dorsifixed, versatile oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* cupular or less often slightly obconical, sessile, usually tightly-clustered, rarely faintly ribbed, 7–10 mm long, 5-7 mm diam; rim thick c.1mm wide; disc descending; valves 3 or 4, enclosed. *Fertile seeds* black, irregularly elongated, flattened, lacunose; hilum ventral.

Flowering period: Spring to early summer.

Distribution and habitat: The new subspecies is known only from a single occurrence which is about 2 km to the south of Mt. Blackwood where it grows in a dry, sclerophyllous forest community on shallow clay soils derived from Silurian sandstone (Fig.1).

Associated species: *E. dives*, *E. radiata*, *E. aromaphloia*, *E. baxteri*, *E. obliqua* and *E. macrorhyncha* occur with the new taxon.

Etymology: The Latin epithet, *fallax* 'false' or 'deceitful', refers to the deceptive appearance of the bark of the new taxon.

Conservation status: The known population consists of about one hundred trees and occurs within the Blackwood Ranges State Park in an area that is relatively secluded. Although it is highly likely that other populations occur in the area, in accordance with IUCN (2001) criteria, a conservation status of endangered is recommended.

Discussion: *E. goniocalyx* subsp. *fallax* is similar to the typical subspecies in most features but differs markedly by its unusual bark, as well as by its taller, more erect habit and its generally longer peduncles (5-12 (-15) mm long in the typical form). The bark of the typical subspecies is box-like to at least the major branches, usually thick and crusty at the base and scaly or tessellated above. The bark of subsp. *fallax* is best described as somewhat peppermint-like, light brown, dull, thin, not appreciably-fractured and superficially smooth in appearance. However, the bark of tallish saplings and immature trees differs from that of the

mature trees, being light grey, thin and scaly. The bark of the new subspecies is not only an aberration within *E. goniocalyx* but distinctive within the Section *Maidenaria* L.D.Pryor & L.A.S.Johnson of which it is a member.

Series *Heterophloiae* Blakely BLUE BOX'

Eucalyptus baueriana Schauer sens. lat. grows in well-watered, fertile soils near the coast and in adjacent foothills scattered from north-west of Sydney to the Latrobe Valley in the Gippsland region of Victoria, with a disjunct occurrence to the west of Melbourne in the Bacchus Marsh area. Its features include a robust, spreading habit to 20 m tall, orbicular, emarginate, blue-green juvenile leaves (to 8 cm long and wide), which may be present in the mature canopy, sub-lustrous, light green adult leaves (6-9 cm long, 2.5-7 cm wide), buds borne on pedicels (2-6 mm long) and conical or funnel-shaped fruits (6-7 mm long, 4-6 mm diam). *Eucalyptus magnificata* L.A.S.Johnson & K.D.Hill was segregated from *E. baueriana* in 1990 to cater for glaucous, large-fruited blue box populations occurring in northern New South Wales and south-eastern Queensland.

The disjunct populations of blue box occurring to the west of Melbourne in the Werribee River catchment have been long-regarded by local observers as being morphologically different to the typical form of *E. baueriana*. A second morphologically different blue box occurring along the Dederick River in East Gippsland was brought to the attention of MEL about six years ago. My investigations of both of these forms have confirmed that they worthy of taxonomic recognition and, hence, they are treated here as two new subspecies of *E. baueriana*.

Key for the subspecies of *E. baueriana*

- 1 Medium trees to 20 m tall; adult leaves sub-lustrous, light green; buds borne on pedicels 2-6 mm long; fruits obconical to funnel-shaped, 6-7 mm long, 4-6 mm diam *subsp. baueriana*
- 1: Small trees or mallees to 12 m tall; adult leaves blue-grey to blue-green or sub-glaucous to glaucous; pedicels 0-3 mm long; fruits obconical to slightly cupular, 3-5 mm long, 3-5 mm diam 2
 - 2 Adult leaves sub-glaucous to glaucous, 5-7 cm long, 4-6 cm wide; fruits 3-4(-5) mm long, 3-4 mm diam. *subsp. dederickensis*
 - 2: Adult leaves blue-green to blue-grey, 3-5 cm long, 2-4 cm wide; fruits 4-5 mm long 4-5 diam *subsp. thalassina*

***Eucalyptus baueriana* Schauer subsp. *thalassina* Rule subsp. nov.**

Eucalyptus baueriana subsp. *thalassina*: A subspeciebus aliis habitu minoribus, foliis juvenilibus minoribus, foliis adultis minoribus hebetibus cineraceis vel glaucescentibus et fructibus minoribus differt.

Type: Victoria: Diggers Rest-Coidamai Road at the Djerriwahrr Creek crossing 37° 37' 07" S. 144° 31' 42" E. 16 iii 2005 K. Rule 2005, MEL 2324023 (Isotypes: CANB, NSW).

Robust, depauperate trees or rarely spreading mallees, 3-12 m tall. Bark grey-brown, box-like, often flaky and loose, persisting to major branches. Seedling leaves ovate to orbicular, shortly petiolate, green, opposite for a few pairs. Juvenile leaves obocordate, sub-orbicular or orbicular, usually emarginate, disjunct, dull, blue-green, 2-4 cm long, 2-4 cm wide; petioles slender, non-pruinose, 2.4-3.6 cm long. Intermediate leaves sub-orbicular or broadly ovate, wider than both juvenile and adult leaves, dull, blue-green, dominating the canopies of saplings and young trees and often persisting in the canopies of mature trees. Adult leaves broadly ovate or broadly lanceolate, dull, blue-green to blue-grey, soft-textured (0.15-0.25 mm thick), 3-5 cm long, 2-4 cm wide; petioles 1.5-3 cm long; venation densely reticulate with conspicuous lateral veins and crowded, unbroken veinlets; intramarginal veins looped, 2-3 mm from the margin; oil glands irregular, small, island or intersectional; summer outer canopy dominated by new leaves that are initially light green and develop a bluish tinge as they mature. Inflorescences 7-flowered, within leafless, branched, terminal panicles; peduncles slender, 7-12 mm long. Floral buds clavate, pedicellate, scarred (outer operculum shed in early bud development), non-pruinose, burnished, 4-5 mm long,

4-5 mm diam; pedicels slender, shorter than the buds, 1-3 mm long; operculum obtuse, c. 2 mm long, as wide as the hypanthium; stamens irregularly inflexed, outer whorls infertile; filaments white, old stamens shed with the staminal ring; anthers adnate, basifix, globoid, dehiscing through lateral pores; ovules in 4 vertical rows. Fruits obconical, shortly pedicellate, thin-walled, 4-5 mm long, 4-5 mm diam.; pedicels 1-3 mm long; disc descending; locules 3 or 4; valves enclosed. Fertile seeds brown, irregular ovoid, finely reticulate; hilum ventral.

Flowering period: Late spring or early summer.

Additional specimens examined: VICTORIA: Long Forest Flora Reserve, steep track at its lowest point, 37° 38' 33" S., 144° 29' 44" E., 28 xii 2006, J.A. Jeanes 1628 and V. Stajsic, MEL 2296388; Cobbleyick Ford Res., on banks of Werribee River, 37° 49' 10" S., 144° 35' 00" E., D.E. Albrecht 3281 MEL 1560786; Djerrirwarrah, 6km NE of Bacchus Marsh, along tributary of Coidamai Creek, 37° 39' 00" S., 144° 29' 45" E., 8 i 1985 S. Forbes 2791, MEL 678644; Werribee River, Werribee, 100 m upstream from scout hall, at the end of Richmond Cres., 37° 53' 53" S., 144° 39' 13" E. MEL 2211236; Pinkinton Forest (Mt. Cottrell Woodland), 1.1 km from Mt. Cottrell Road and 1.6 km from Greig Road, 37° 46' 39" S., 144° 35' 39" E., 10 i 1993 V. Stajsic 889 MEL 2019805; Exford, Griggs Road West, on the eastern slope above the Werribee River, 37° 44' 55" S., 144° 34' 35" E., 25 iii 2005, K. Rule 2805, MEL 23244024.

Distribution and habitat: The new subspecies grows close to watercourses in alluvial soils in the Werribee River catchment, both downstream from Bacchus Marsh along the Werribee River Valley and to the north-east of Bacchus Marsh along Coidamai and Djerrirwarrah Creeks which feed into the Werribee River (Fig. 1).

Associated species: Where it occurs in the northern part of its distribution *E. baueriana* subsp. *thalassina* most often grows in pure populations but may be found close to such species as *E. tricarpa* subsp. *tricarpa*, *E. leucoxylon* subsp. *connata* Rule, *E. polyanthemos* Schauer subsp. *vestita* L.A.S.Johnson & K.D.Hill, *E. polyanthemos* subsp. *marginalis* Rule, *E. goniocalyx* subsp. *goniocalyx*, *E. melliodora*, *E. macrorhyncha*, *E. cephalocarpa* Blakely, *E. behriana* F.Muell., *E. microcarpa* Maiden and *E. dives*, all of which occur on higher, well-drained sites. Along the Werribee River *E. camaldulensis* subsp. *camaldulensis* may be an associate.

Etymology: The epithet is derived from the Latin *thalassinus* 'sea-green' which alludes to the attractive colour of the new summer adult leaves.

Conservation status: The exact numbers of the new subspecies are not known but it is estimated that only a few thousand trees exist, most of which occur in the northern part of the distribution along the Coidamai and Djerrirwarrah Creeks which form a part of the Werribee River catchment. The Coidamai Creek, in particular, feeds into the reserve of the Lake Merrimur Reservoir and flows through to the Long Forest Flora Reserve, both of which currently provide protection to substantial numbers of the taxon. In accordance with IUCN (2001) criteria, a conservation status of endangered is recommended.

Discussion: *Eucalyptus baueriana* subsp. *thalassina* differs from the typical subspecies by its smaller habit, smaller juvenile leaves, smaller, duller adult leaves, smaller buds with shorter pedicels and smaller fruits. This new subspecies differs from subsp. *deddicensis* which has larger, sub-glaucous to glaucous adult leaves and generally smaller buds and fruits.

A form of red box, *E. polyanthemos* subsp. *marginalis* Rule, which is a common eucalypt in the Brisbane Ranges and adjacent areas, has been erroneously referred to as *E. baueriana*, possibly because its adult leaves are lustrous and green. This form of red box is mostly found on elevated sites in poor, well-drained soils, whereas *E. baueriana* subsp. *thalassina* occurs along water courses and drainage lines in fertile soils. The red box can be further distinguished by its more or less barrel-shaped, relatively thick-walled fruits and its appreciably coarse, ovate adult leaves.

Eucalyptus baueriana Schauer subsp. *deddicensis* Rule subsp. nov.

Eucalyptus baueriana subsp. *deddicensis*: A subspecies *alii habitu minoribus, foliis adultis glaucis et fructibus minoribus differt.*

Type: Victoria: On the bank of the Deddick River, 10 km by road upstream from Ambyne Settlement Road, 37° 02' 44" S., 148° 32' 17" E., 18 viii 2006, K. Rule 8106 and K. Parker, MEL 23244022 (Isotypes: AD, NSW, CAN)

Small, depauperate, mallee-like trees, 4-8 m tall. Bark whitish or light grey, thin, box-like, scaly, persisting to major branches; bark on branches smooth, white, shed in short ribbons. Seedling leaves ovate to orbicular, shortly petiolate, green, opposite for a few pairs. Juvenile leaves obcordate, sub-orbicular or orbicular,

usually emarginate, disjunct, dull, blue-green, 3-5 cm long, 3-5 cm wide; petioles slender, 1.5-2.5 cm long. Intermediate leaves sub-orbicular or broadly ovate, dull, blue-green to sub-glaucous, present in the canopies of saplings, young trees and mature trees, larger than adult leave. Adult leaves broadly ovate or sub-orbicular, relatively sparse, sub-glaucous to glaucous, thin-textured (0.15-0.25 mm thick), 5-7 cm long, 4-6 cm wide; petioles 1.5-3 cm long; venation densely reticulate with conspicuous lateral veins and crowded, unbroken veinlets; intramarginal veins looped, 2-3 mm from the margin; oil glands irregular, small, island or intersectional. Inflorescences 7-flowered, within leafless, branched, terminal panicles; peduncles slender, 6-11 mm long. Floral buds clavate, sessile or shortly pedicellate, scarred (outer operculum shed in early bud development), non-pruinose, burnished, 4-5 mm long, 2.5-3.5 mm diam.; pedicels 0-3 mm long; operculum obtuse, 1-2 mm long, as wide as or slightly narrower than the hypanthium; stamens irregularly inflexed, outer whorls infertile; filaments white, old stamens shed with the staminal ring; anthers adnate, basifixed, globoid, dehiscing through lateral pores; ovules in 4 vertical rows. Fruits obconical or slightly cupular, sessile or shortly pedicellate, thin-walled, 3-5 mm long, 3-4 mm diam.; pedicels, if present, 1-2 mm long; disc narrow, descending; locules 3 or 4; valves enclosed. Fertile seeds brown, irregular ovoid, finely reticulate; hilum ventral.

Flowering period: Late spring to early summer.

Additional specimen examined: VICTORIA: Deddick River, adjacent to Deddick Park Station, 37° 03' 37"S., 148° 30' 45"E., 20 iv 2009, K. Rule 0209, MEL 23244021.

Distribution and habitat: *E. baueriana* subsp. *deddicensis* is known only from two restricted, relatively isolated populations on the banks of the Deddick River in East Gippsland where it prefers soils of granite origins (Fig. 1).

Associated species: The new subspecies grows in pure stands but abuts *E. albens* Benth. at its boundaries. Other species occurring in the area include *E. bridgesiana* R.T.Baker, *E. melliodora*, *E. microcarpa* and *E. macrorhyncha*.

Etymology: The epithet refers to the locality where the new taxon occurs.

Conservation status: The subspecies is known from

two small populations occurring along the Deddick River on public land where the total number of plants is estimated to be close to 200. However, it is highly likely that other similarly small populations exist in the Deddick River catchment. In accordance with IUCN (2001) criteria, a conservation status of endangered is recommended.

Discussion: The new subspecies is considered to be closely related to *E. baueriana* despite it resembling some glaucous forms of *E. polyanthemos* subsp. *vestita* which also occur in East Gippsland. However, its riparian habitat, thin-textured adult leaves, clavate buds and thin-walled, conical fruits indicate that it is a form of *E. baueriana*. The typical subspecies of *E. baueriana* also occurs in the region of East Gippsland but in sub-coastal and coastal forests on deep, fertile soils. *E. baueriana* subsp. *baueriana* further differs from the new subspecies by its more robust, taller habit, sub-lustrous, light green adult leaves, larger buds, which are usually borne on longer pedicels, and larger fruits.

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